REMARKS

In the September 7, 2005 Office Action, the Examiner noted that claims 1-13 were pending in the application and rejected all the claims under 35 U.S.C. § 103(a). In rejecting the claims, U.S. Patents, 4,462,046 to Spight; 5,745,387 to Corby, Jr. et al. (References A and B in the January 25, 2005 Office Action); 4,611,292 to Ninomiya et al.; and 4,504,970 to Werth et al. (References B and C in the December 30, 2002 Office Action) were cited. Claim 14 has been added and thus, claims 1-14 remain in the case. The Examiner's rejections are traversed below.

Rejections under 35 USC § 103

In items 4-13 on pages 2-6 of the Office Action, claims 1, 3, 4, and 8-13 were rejected under 35 U.S.C. § 103 as being unpatentable over Spight in view of Corby, Jr. et al.; in items 14-18 on pages 6-8 of the Office Action, claims 2, 5 and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over Spight in view of Corby, Jr. et al. and further in view of Werth et al.; and in items 19 and 20 on page 8 of the Office Action, claim 7 was rejected as unpatentable over Spight in view of Corby, Jr. et al. and Werth et al. and further in view of Ninomiya et al. using the same language as in the January 25, 2005 Office Action, except for the last four lines of item 16 on page 7 which merely provide a basis for combining the references.

Although the wording of the rejection written by the previous Examiner was not changed, a Response to Arguments on pages 9-11 of the September 7, 2005 Office Action provided additional justification for the rejection as set forth on pages 2-8. The rejection acknowledged that Spight "does not disclose that one of the reference object and said image pickup device is ... movable and positionable ... to a plurality of different image pickup positions and directions, or that direction information ... is stored with the image data as a teaching model" (Office Action, page 3, lines 4-8). The Response to Arguments cited additional statements in the Background and Summary of the Invention sections of Spight, but also acknowledged that "Spight does not specifically teach

> wherein one of the (either) (a) reference object and (or) said image pickup device is fixed to a movable and positionable part of a robot or is grasped with a hand of the robot, and said robot is operated for positioning to a plurality of different image pickup positions and directions, so that the image data respectively obtained at each of said different image pickup positions and direction information indicating the respective different direction, is stored as a teaching model

(Office Action, page 10, lines 1-6), as recited (except for the words in parentheses), e.g., in claim 1 at lines 10-15. However, in both the rejection and the Response to Arguments, it was asserted

that the teaching in Corby, Jr. et al. of an archive and comparison device would make it obvious to one of ordinary skill in the art to modify Spight to include the missing features.

Newly Cited Portions of Corby, Jr. et al.:

The Response to Arguments also cited additional statements in the Background and Summary of the Invention sections, as well as in the Detailed Description of the Invention section of Corby, Jr. et al. that were not cited in the rejection on pages 2-8 of the Office Action. However, these additional statements do not suggest modification of Spight to meet the limitation quoted above and do not overcome the deficiencies of the combination of Spight and Corby, Jr. et al. identified in the April 14, 2005 Response.

The newly cited portions of the Background of the Invention section in Corby, Jr. et al. describe "[m]anipulator arms ... useful for inspection of machines or structures which are in environments which are inaccessible or very hazardous for humans" (column 1, lines 32-34) and the prior art inspection method that was improved upon by Corby, Jr. et al. "to determine the rate of deterioration[,] the manipulator arm [is moved] to a particular position ... [for] videotaping the structure or device which is to be examined. At a later date the manipulator arm is positioned at the same site and current data (such as a video image) is compared to previous data" (column 1, lines 55-60). All of this portion of Corby, Jr. et al. teaches away from using Corby, Jr. et al. to modify Spight or that Corby, Jr. et al. is relevant to the invention, since neither Spight nor the invention are directed to operations in "environments which are inaccessible or very hazardous for humans" or "to determine the rate of deterioration" as in Corby, Jr. et al.

The newly cited portions of the Summary of the Invention section in Corby, Jr. et al. describe "[a] viewpoint for rendering a computed view of the environment ... determined by the operator (either by inputting viewpoint coordinates or by selecting from a pre-established list of viewpoint coordinates)" (column 2, lines 33-36) to "allow the environment renderer to produce images corresponding to views of the environment as 'seen' from the viewpoint of the utility package" (column 2, lines 47-49). Once again, this is irrelevant to "recognizing, generating and storing ... teaching models" (claim 1, lines 8-9).

The newly cited portions of the Detailed Description of the Invention section in Corby, Jr. et al. describe a viewpoint obtained from "operator-supplied input" (column 5, line 2); "rapid, accurate determination of irregularities ... such as [in] off-line maintenance of a nuclear power plant" (column 6, lines 7-9); comparison of a "video image ... acquired of [a] suspect site" with "[a] current video image ... viewed side-by-side" (column 6, lines 12-15); that "[r]etrieval control computer 53, upon command by operator 2, retrieves all past data from storage device 51 which

is pertinent to the site currently being examined and visited by the utility package at distal end 10b of manipulator arm 10" (column 6, lines 55-58); that "SP&V unit 55 transforms images archived in sensor data storage device 51, according to the position, orientation and imaging parameters, to match those of images currently being acquired by utility package 11" (column 6, lines 61-65); and that "[r]etrieval control computer 53 may select two archived images to compare against each other instead of one archived and one current image" (column 7, lines 15-17).

Distinctions over Prior Art

As described in the Response filed April 14, 2005, neither Spight nor Corby, Jr. et al. teach or suggest that "one of the reference object and said pickup device is fixed to a movable and positionable part of a robot ... for positioning to a plurality of different image pickup positions and directions ... [that are] stored as a teaching model" (claim 1, last 6 lines). The alternative embodiment in Spight in which "a plurality of configurations of each desired object to be identified" (column 9, lines 6-7) are stored for comparison with a single view of the object to be identified, contains no suggestion of how the plurality of configurations are obtained.

As also discussed in the April 14, 2005 Response, there is no suggestion in Corby, Jr. et al. of storing a plurality of views for the purpose of **identifying** anything. The archive and comparison device taught by Corby, Jr. et al. is used for determining deterioration at a given inspection site, not identification. No description has been cited or found in Corby, Jr. et al. regarding how an operator determines what file should be used for comparison. Presumably the typical technique of using a naming convention for the files would be used, since other textual data can be input via text input device 57 (see column 6, lines 41-51). There is not the slightest suggestion that the site where deterioration is occurring is identified "by carrying out pattern matching processing of an image" (claim 1, lines 5-6), either automatically, or by an operator.

In response to the argument in the preceding paragraph, the Response to Arguments section of the Office Action cited column 4, line 66 to column 5, line 2 and column 6, lines 10-30 of Corby, Jr. et al. (none of which was cited in the rejection) as disclosing "teaching models based on the image data" (Office Action, page 10, line 22) based on "images at different orientations or directions (viewpoints)" as described at column 2, lines 33-40 and 45-52 of Corby, Jr. et al. (none of which was cited in the rejection).

As discussed above, these portions of Corby, Jr. et al. merely describe recording images of a site from various viewpoints and providing the images for comparison by a human operator. No form of the word "teach" is used in Corby, Jr. et al., while the word "model" and other forms of

this word are used to refer to "an environment modeler which creates a computer model of the environment" (Abstract, lines 2-3) as briefly noted in the first paragraph of the Summary of the Invention and "a prestored model of the manipulator arm" (Abstract, lines 13-14). These models are described at column 3, line 63 to column 4, line 17 and column 4, lines 45-51. As described therein, the environment modeler relies on "blueprint measurements, position and shape measurements, and material types" (column 3, lines 64-65) in "defining an environment" (column 3, line 63) in which a manipulator arm operates, while the manipulator arm modeler is used for "defining the geometry of a manipulator arm" (column 4, line 6). These models are used for determining the viewpoint of the images taken by a camera or other sensors used to obtain sensor input at the distal end of the manipulator arm.

There is no suggestion that the models disclosed in Corby, Jr. et al. are "teaching models" as that term is used in the specification and claims of the subject application. Claim 1 recites "the image data respectively obtained at each of said different image pickup positions and direction information indicating the respective different direction, is stored as a teaching model" (claim 1, last 3 lines). This is consistent with the first paragraph of the Description of the Prior Art section of the subject application which refers to "storing a two-dimensional image of the object for detection as a teaching model, prior to pattern matching of the teaching model with image data produced by ... a camera", the examples of teaching models illustrated in Fig. 4 (see page 5, line 5) and the distinction between "teaching model" and "relative position and posture of each teaching model to the workpiece" in the numbered paragraphs on page 2 of the application. Thus, the "teaching model" recited in the claims is not a model of the environment or the manipulator arm used to determine a viewpoint as taught by Corby, Jr. et al., but rather a model of what is to be "recognized by carrying out pattern matching processing of an image of the subject" (claim 1, lines 5-6). As a result, there is no disclosure or suggestion in Spight or Corby, Jr. et al. of using a "teaching model" as recited in the claims.

Furthermore, there is no suggestion that the models disclosed in Corby, Jr. et al. are used in "pattern matching processing of an image of the subject" (claim 1, lines 5-6) by "an image processing system" (claim 1, line 5). The assertion that "pattern matching is nothing but comparing images" (Office Action, page 11, lines 4-5) by a human operator as taught by Corby, Jr. et al. is inconsistent with both the common meaning of the term "pattern matching" in the robot art and the use of this term in the specification. For example, in addition to the use of the term "pattern matching" in the quotations in the preceding paragraph, the Description of the Prior Art section of the subject application states that "a device for detecting the three-dimensional position and posture (direction) of the individual workpiece ... performs the ... operations" (page

2, lines 9-11) in the numbered paragraphs on page 2 of the application. Note that the device is not used by a human to perform these operations, the device itself performs the operations. The Detailed Description of the Preferred Embodiments of the invention confirms that "the processor 31 detects a workpiece by performing pattern matching by using one ... of the teaching models" (page 22, lines 19-20).

The use of the term "pattern matching" in the application as an operation performed by a device, not a human is consistent with the definition of the term in the robot art. For example, on the Wikipedia website, "pattern matching" is defined as "checking for the presence of the constituents of a given pattern. In contrast to pattern recognition, the pattern is rigidly specified" (see Exhibit A attached hereto). Thus, "pattern matching" is a special case of "pattern recognition" which is defined in the IEEE Standard Dictionary of Electrical and Electronics Terms, Third Edition, ANSI/IEEE Std 100-1984 (see Exhibit B attached hereto) as the "identification of shapes, forms, or configurations **by automatic means**" (emphasis added) and in the Microsoft Press Computer Dictionary, Fourth Edition, 1999 (see Exhibit C attached hereto) as "a broad technology describing **the ability of a computer to identify patterns**" (emphasis added). See also the statement in the article by Lee et al. submitted in the Information Disclosure Statement filed herewith, "[t]he robot automatically decides whether it uses geometric pattern matching (i.e. walls, pillars) by Hough transform" (Abstract, lines 10-12). Thus, when the claims recite "an image processing system with which a current three-dimensional orientation of the subject object relative to an image pickup device is recognized by carrying out pattern matching processing" (claim 1, lines 4-6), it is the image processing system that performs the pattern matching, not a human as taught by Corby, Jr. et al.

For at least the reasons set forth above, it is submitted that claim 1 patentably distinguishes over Spight in view of Corby, Jr. et al. Since claims 3 and 4 depend from claim 1, it is submitted that claims 3 and 4 similarly distinguish over Spight in view of Corby, Jr. et al. for at least the reasons set forth above with respect to claim 1.

Remaining Claims Distinguish over Prior Art
As discussed in April 14, 2005 Response

Claim 8 recites "determining a current three-dimensional orientation of a subject object relative to an image pickup device by carrying out pattern matching processing of an image of the subject based on a plurality of predetermined teaching models of a reference object" (claim 8, lines 3-5), where the teaching models are generated

> on the basis of respective image data produced by taking images of said reference object from a plurality of directions, wherein one of the reference object and said image pickup device is fixed to a movable and positionable part of a robot ..., and said robot is operated for positioning to a plurality of different image pickup positions and directions

(claim 8, last 7 lines). Therefore, it is submitted that claim 8 patentably distinguishes over Spight in view of Corby, Jr. et al. for the reasons set forth above with respect to claim 1.

With respect to claim 9, as discussed above with respect to claim 1, there is no suggestion in the combination of Spight and Corby, Jr. et al. of "using pattern matching to match one of the stored images with the current image" (claim 9, lines 10-11), where the stored images are generated by "images ... captured by a plurality of robotic operations corresponding to ... different relative orientations of the subject" (claim 9, lines 3-5) and the current image is "of a workpiece that has an unknown orientation relative to an image pickup device on the robot before the robot has come into contact with the workpiece, where the workpiece has a shape substantially similar to the shape of the subject" (claim 9, lines 7-9). Therefore, it is submitted that claim 9 and claims 10 and 11 which depend therefrom patentably distinguish over Spight in view of Corby, Jr. et al. for at least the reasons set forth above with respect to claim 1.

Although the wording of claim 12 is not identical to claim 9, there are sufficient similarities that it is submitted that claim 12 patentably distinguishes over Spight in view of Corby, Jr. et al. for at least the reasons set forth above with respect to claims 1 and 9.

With respect to claim 13, as discussed above with respect to claim 1, there is no suggestion in the combination of Spight and Corby, Jr. et al. of "determining a current workpiece-camera orientation by matching one of the images or data thereof with the current image" (claim 13, lines 7-8), where "the images" are "robotically ...[taken] images of a subject with different three-dimensional subject-camera arrangements that vary in three dimensions" (claim 13, lines 2-3) and the "current image [is] of a workpiece shaped like the subject" (claim 13, line 5). Therefore, it is submitted that claim 13 patentably distinguishes over Spight in view of Corby, Jr. et al. for the reasons set forth above with respect to claim 1.

In items 14-18 on pages 6-8 of the Office Action, claims 2, 5 and 6 were rejected as unpatentable over Spight in view of Corby, Jr. et al. and further in view of Werth et al. and in items 19 and 20 on page 8 of the Office Action, claim 7 was rejected as unpatentable over Spight in view of Corby, Jr. et al. and Werth et al. and further in view of Ninomiya et al. Nothing has been cited or found in Werth et al. or Ninomiya et al. suggesting modification of the combination of Spight and Corby, Jr. et al. to overcome the deficiencies discussed above.

Therefore, it is submitted that claims 2 and 5-7 patentably distinguish over Spight in view of Corby, Jr. et al., Werth et al. and Ninomiya et al. for at least the reasons set forth above with respect to claim 1 from which they depend.

New Claim 14

Claim 14 has been added to recite a computer-readable medium storing instructions that when executed control a robot apparatus to perform a method similar to that recited in claim 13. Therefore, it is submitted that claim 14 patentably distinguishes over the applied art for the reasons set forth above with respect to claim 13.

Specifically, the applied art does not teach or suggest "determining a current workpiece-camera orientation by matching one of the images with the current image" (claim 14, lines 9-10), where "the images" are obtained by "robotically taking images of a subject with a camera in different subject-camera arrangements varying in three dimensions" (claim 14, lines 3-4) and the "current image [is] of a workpiece shaped like the subject" (claim 14, lines 7-8). Therefore, it is submitted that claim 14 patentably distinguishes over the applied art for the reasons set forth above with respect to claim 1.

Request for Examiner Interview

If the Examiner is not persuaded by the arguments and evidence submitted herewith that the claims must be interpreted to require pattern matching by the image processing system and not a human comparing images as taught by Corby, Jr. et al., the Examiner is respectfully requested to contact the undersigned prior to issuing another Office Action, in accordance with MPEP § 706.07(b), to discuss what further amendments to the claims will clarify the differences between the invention and the prior art.

Summary

It is submitted that references taken alone or in combination with any suggestions of the prior art in the application, do not teach or suggest the features of the present claimed invention. Thus, claims are in a condition suitable for allowance. Reconsideration of the claims and an early Notice of Allowance are earnestly solicited.

If there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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